CLAIMS

What is claimed is:

1. A method of measuring feature parameters in a microelectronic fabrication process, comprising:

taking a first optical metrology measurement at a feature location on a sample after a first step in a fabrication process;

determining first parameters for the feature location from the first optical metrology measurement;

taking a second optical metrology measurement at the same feature location after a subsequent step in the fabrication process; and

determining second parameters for the feature location based on the determined first parameters and the second optical metrology measurement.

2. A method according to claim 1, further comprising:

retaining the first parameters in memory for use in determining the second parameters.

3. A method according to claim 1, wherein:

determining first parameters includes determining at least one of a critical dimension, profile, refractive index, extinction coefficient, and layer thickness at the feature location.

4. A method according to claim 1, further comprising:

passing said first parameters to a tool for executing the subsequent step in the fabrication process.

5. A method according to claim 1, further comprising:

using a feature model to determine the second parameters.

6. A method according to claim 5, further comprising:

fixing at least one parameter in the feature model using said retained first parameters.

7. A method according to claim 5, further comprising:

selecting the feature model for said feature location after the subsequent step.

8. A method according to claim 1, wherein:

determining the second parameters includes performing a three-dimensional characterization of the features being examined.

9. A method according to claim 1, further comprising:

illuminating a spot on the feature with a broadband light source.

10. A method according to claim 9, further comprising:

focusing light from the broadband light source to the spot on the microelectronic feature using at least one optical element selected from the group consisting of focusing lenses, focusing mirrors, and narrowing apertures.

11. A method according to claim 9, further comprising:

polarizing the light from the broadband light source using a polarizing element positioned between the broadband light source and the microelectronic feature.

12. A method according to claim 9, wherein:

illuminating a spot on the feature with a broadband light source includes light of multiple wavelengths.

13. A method according to claim 1, wherein:

taking a first optical metrology measurement includes using a spectrometer to measure characteristics of light returned from the feature location.

14. A method according to claim 13, wherein:

the characteristics being measured are selected from the group consisting of reflection intensity, polarization state, and angular distribution.

15. A method according to claim 1, further comprising:

feeding forward the first parameters to a second metrology tool when the first and second metrology measurements are taken using respective first and second metrology tools.

16. A method according to claim 1, wherein:

determining second parameters includes using a theoretical model to calculate a predicted optical signal characteristic of the microelectronic feature, and adjusting measurement parameters in the model to minimize discrepancies between the predicted optical signal and a measured optical signal.

17. A method according to claim 16, wherein:

the first parameters are used to reduce the number of measurement parameters adjusted to minimize discrepancies.

18. A method according to claim 16, further comprising:

selecting a set of trial values for the measurement parameters to be used in the theoretical model, wherein the values for any measurement parameters corresponding to said first parameters are fixed to the values of the corresponding first parameters.

19. A method according to claim 16, wherein:

adjusting the measurement parameters includes using an automated fitting optimization algorithm to iteratively adjust measurement parameters.

20. A system for high-speed, non-destructive measurement of a feature on a semiconductor, comprising:

a first metrology tool including a first radiation source operable to illuminate a spot on the semiconductor containing said feature, and a first optical metrology detector operable to measure radiation reflected from the spot on the semiconductor to obtain a first optical metrology measurement of the feature after a first step in a fabrication process, the first metrology tool capable of determining first parameters for the feature from the first optical metrology measurement; and

a second metrology tool including a second radiation source operable to illuminate the spot on the semiconductor containing said feature, and a second optical metrology detector operable to measure radiation reflected from the spot on the semiconductor to obtain a second optical metrology measurement of the feature after a second step in the fabrication process, the second metrology tool capable of receiving the first parameters from the first metrology tool and determining second parameters for the feature based on the first parameters and the second optical metrology measurement.

21. A system according to claim 20, wherein:

the second metrology tool and the first metrology tool comprise the same metrology tool.

22. A system according to claim 20, wherein:

the first and second metrology tools are capable of determining first and second parameters selected from the group consisting of critical dimension, profile, refractive index, extinction coefficient, and thickness of the feature.

23. A system according to claim 20, further comprising:

means for passing said first parameters to the second metrology tool.

24. A system according to claim 20, further comprising:

a feature model available to the second metrology tool for determining the second parameters.

25. A system according to claim 20, wherein:

the second metrology tool can fix at least one variable parameter in the feature model using said retained first parameters.

26. A system according to claim 20, further comprising:

a radiation focusing element in at least one of the first and second metrology tools for focusing radiation from the radiation source to the spot on the semiconductor, the radiation focusing element including at least one optical element selected from the group consisting of focusing lenses, focusing mirrors, and narrowing apertures.

27. A system according to claim 20, further comprising:

a polarizing element positioned between the radiation source and the feature in at least one of the first and second metrology tools, operable to polarize the radiation from the radiation source.

28. A system according to claim 20, wherein:

at least one of the first and second metrology tools is further capable of illuminating a spot on the feature with radiation of multiple wavelengths.

29. A system according to claim 20, wherein:

at least one of the first and second metrology tools is further capable of measuring radiation comprising at least one of reflected light and diffracted light.

30. A system according to claim 20, further comprising:

processing means for determining the second parameters using a theoretical model to calculate a predicted optical signal characteristic of the feature, and for

adjusting variable parameters in the model to minimize discrepancies between the predicted optical signal and a measured optical signal.

31. A system according to claim 30, wherein:

the processing means utilizes the first parameters to reduce the number of variable parameters capable of being adjusted to minimize discrepancies.

32. A system according to claim 30, further comprising:

a set of trial values to be used as initial values for the variable parameters in the theoretical model, wherein the values for any variable parameters corresponding to said first parameters are fixed to the values of the corresponding first parameters.

33. A system according to claim 30, further comprising:

an automated fitting optimization algorithm available to said processor for iteratively adjusting the variable parameters.

34. A system according to claim 20, wherein:

at least one of said first and second metrology tools comprises a spectrometer.